Journal of Assisted Reproduction and Genetics, Vol. 19, No. 9, September 2002 (© 2002)

Ethical Considerations

Is Any Form of Gender Selection Ethical?

Charles Hanson,[1] Lars Hamberger,[1,2] and Per Olof Janson[1]

Submitted March 6, 2002; accepted March 8, 2002

In later years, sex selection has become of importance for prevention of X-linked diseases in families at risk. There is today a potential to perform sperm selection before fertilization by taking advantage of the chromosomal heterogamy of spermatozoa, and before implantation by preimplantation genetic diagnosis (PGD). The methods of sex determination by separating spermatozoa are, in our opinion, still not safe enough for routine clinical use. Apart from the technical problems and possible associated risks, which first must be better evaluated, the most critical questions are ethical or legal. We support the use of sex selection by PGD in X-linked severe disease, but due to the potential risks of misuse, we are not prepared to support a more liberal attitude as long as the discriminated sex in nearly all parts of the world are women.

KEY WORDS: PGD; sex selection; social sexing; spermatozoa; X chromosome; Y chromosome.

The interest in sex selection has a long cultural history in man and is often consciously or unconsciously associated with discrimination of the undesired sex. However, in later years sex selection has also become of importance for prevention of X-linked diseases in families at-risk (1–3). There is today a potential to perform sperm selection before fertilization and before implantation by preimplantation genetic diagnosis (PGD), during pregnancy by prenatal diagnosis (amniocentesis or chorionic villi biopsy) and, at least in the second half of gestation, by sonography.

We discuss here the possibility making sex selection prior to conception by taking advantage of the chromosomal heterogamy of spermatozoa. In later years, several techniques have been tested to separate human X-chromosome-bearing sperms from Y-chromosome-bearing sperms. All methods more or less make use of the fact that the Y-chromosome is slightly smaller than the X-chromosome, resulting in approximately a 2.8% difference of the DNA content in a Y-chromosome-bearing sperm compared to a X-chromosome bearing sperm. Examples of medical techniques tested so far are swim-up separations, and separation using Sephadex columns and Percoll gradients. In animal studies, also elutriator centrifugation has been claimed to separate X- and Y-bearing sperm with good precision. None of these techniques are, however, proven to be good enough for clinical use. Although used clinically for some years, the putative effects of sperm separation by albumin-gradient centrifugation is also still unclear. Today a system for separation of human X- and Y-chromosome-bearing sperm using flow cytometry is described (4–5). By staining the DNA in the sperm heads with a fluorochrome, which will be exited using UV-light, the amount of DNA in a single sperm can be measured as emitted light by fluorescence detectors. Although the mutagenicity of the fluorochrome used and the UV-light have been tested in bacterial and animal systems (4), the effects on human sperm DNA and/or long term effects on eventual offspring is still unknown. Hence, using this system in the humans, must still be done under the conditions of a clinical trial.

[1] Department of Obstetrics and Gynecology, Sahlgrenska University Hospital, S-413 45 Göteborg, Sweden.
[2] To whom correspondence should be addressed; e-mail: lars.hamberger@obgyn.gu.se.

1058-0468/02/0900-0431/0

Apart from the technical problems and possible associated risks, which first must be better evaluated, the most critical questions are ethical or legal. In many countries such as Sweden, legal restrictions will under any circumstances prohibit the use of sex selection that is not associated with disease (2). We have so far been comfortable with this law, even if occasional couples with 4–5 children of the same sex may have our sympathy when they apply for help. However, taken into consideration the potential risks of misuse of the sex selection techniques we are not prepared to support a more liberal attitude as long as the discriminated sex in nearly all parts of the world are women. In a longer historical perspective it seems important that Nature's own sex ratio is preserved. In cases of sex linked monogenic diseases, we have, however, no problem to welcome the new technical possibilities for sex selection.

REFERENCES

1. Handyside AH, Peneketh RJA, Winston RML, Pattinson JK, Delahanty JDA, Tuddenham EGD: Biopsy of human preimplantation embryos and sexing by DNA amplification. Lancet 1989;Feb18:347–349
2. Hanson C, Jakobsson A-H, Sjögren A, Lundin K, Nilsson L, Wahlström J, Hardarson T, Stevic J, Darnfors C, Janson PO, Wikland M, Hamberger L: Preimplantation genetic diagnosis (PGD): The Gothenburg experience. Acta Obstet Gynecol Scand 2001;80:331–336
3. ESHRE PGD consortium: ESHRE Preimplantation genetic diagnosis consortium: Data collection III (May 2001). Hum Reprod 2002;17(1):233–246
4. Fugger EF: Clinical experience with flow cytometric separation of human X- and Y-chromosome beraring sperm. Theriogenology 1999;52:1435–1440
5. Bick DP, Harton GL, Stern HJ, Fallon LA, Blauer KL, Keyvanfar K, Fugger EF: Flow-cytometric sperm separartion in preimplantation genetic diagnosis (PGD) of X-linked Disease. Eur J Hum Genet 2001;9(Suppl 1):93–94